SPECIFICATION

[Electronic Version 1.2.8]

Model Submarine Control/Propulsion System

Brief Summary of the Invention

[0001] This is a completely functional Model Submarine (4ft.to7ft. depending on propulsion system proposed herein). The working prototype has been developed and is shown in the attached pictures. The application is for the control/propulsion system used to make this submarine functional. The submarine selected for development of this prototype while resembling the Jules Verne submarine is significantly different from typical model submarines. Unlike other model submarines, it does not have a movable rudder, it does not have a propeller, it does not have movable dive planes, or movable rudder, it does however have propulsion jets in the forward and rear sections of the submarine, these are fixed jet nozzles. The submarine is a wet hull design, meaning that water is allowed to fill the hull through various vents. Water inside the hull is propelled as thrust to various fixed directional jet nozzles. The propulsion jets are powered by bilge pumps. Each bilge pump is responsible for a specific direction e.g. left, right, down, forward. Combinations of jets also control direction. The submarine itself could have been constructed from a PVC pipe 4 ft. to 7ft (or any reasonable dimension) long with tapered ends. The submarine hull shape is not important, (but should be fusiform) rather, the use of bilge pumps, ballast adjustment and radio control constitute the subject of this patent application.

[0002] Unlike conventional RC boats and submarines this model has no propeller and no servos. It is entirely jet propelled using internal bilge pumps with fixed jet nozzles, for propulsion and maneuvering. It is unique as a model submarine in that there are no external moving parts. It uses a dynamic ballast system in combination with forward and downward thrust for submerging. In other words the sub must be moving forward in order for it to dive. Otherwise, it has positive buoyancy and will remain on the surface. Buoyancy is achieved with typical trim methods using common insulating foam or other suitable material and either internal or external weights consisting of any suitable heavy material. A static diving system would also work with this system, but would involve more components and forego the automatic safety of a permanently buoyant model. The model turns, submerges, surfaces, and goes forward and reverse without any moving parts. The remote control system is unique as well in that there are no servos or other mechanical control devices, which are easily subject to failure. Electronic controls consist of solid-state electrical switches and automotive type relays.

[0003] The sub submerges when the down pump in front forces the front end down at a slight angle. In combination with forward thrust the sub will slip under the water at a gradual angle. Releasing the down pump will bring the sub to a level position underwater. Releasing all controls will bring the sub directly to the surface since it is positively buoyant.

[0004] The primary value of the product to a model submarine enthusiast is that the sub is very simple to construct and operate since the only moving parts involved are only the bilge pumps themselves (the turbine in the pump itself rotates to pump the water) and the fact that this submarine will not sink (when the forward thrust is terminated either through loss of signal or by intention). Bilge pumps are readily available, relatively inexpensive and very dependable. They are ideal as miniature turbine units for a model submarine propulsion system.

Detailed Description of the Invention

[0005] The submarine uses a dynamic ballast system for submerging (although a static diving system is not precluded). This means that in order for the sub to submerge it must be moving forward. Also it must be properly trimmed (leveled) using typical model submarine methods consisting of foam and weights for example. The advantage of this type of system is that the sub will always surface when radio control is terminated. Additionally, forward speed is required to keep the sub underwater. In the event of a radio malfunction, or loss of signal, the sub will surface. As battery power diminishes the submarine slows down losing its ability to stay submerged. Forward thrust and sufficient power is required to submerge sub and keep it cruising underwater. Additional external or internal ballast must be added or removed until proper balance is achieved to submerge the sub. For the additional ballast an external steal bar can be mounted on the bottom as an adjustment to vary the angle and depth of submergence. Otherwise, without the external or internal ballast, it has positive buoyancy and will remain on the surface. The ballast is used to lower the plane of the sub to allow it to respond to the down submerge controls. Without this ballast the sub remains on the surface. This is useful when only surface control is desired. This can be in situations where the water is shallow or heavily weeded and could constitute an underwater snagging hazard.

[0006] Bilge pumps power the sub. These types of pumps are available at any marine supply store. The bilge pumps are located in the hull with four (can vary) nozzles in the front and two (can vary) in the back. The watertight chamber inside the submarine hull (made of PVC pipe or other material sealed at both ends with protruding control wires) contains the radio receiver, solid-state electrical switches, and automotive type relays. This is a short piece of PVC pipe sealed at both ends with only the electrical wires protruding. The relays are controlled by the solid-state switches, which are plugged into the RC receiver. Electrical power from the 12 volt sealed batteries is conveyed into the watertight chamber and at the control of the operator is directed to the various bilge pumps for model operation. The bilge pumps are either on or off there is no proportional control and none is needed but could be incorporated. The solid-state electrical switches are rated at about six (can vary) amps. Automotive relays are added as a

safety measure since they can handle 30 amps (can vary), which exceeds the amp requirement for the bilge pumps. The bilge pumps are either on or off there is no need to reduce voltage with an electronic speed control. The bilge pumps operate on 12 volts DC current (can vary).

[0007] Water continuously enters the sub's hull through vents and the bilge pumps discharge it out under pressure providing controlled thrust.

[0008] Once submerged, the sub is self-leveling because of the reduced forward thrust/trimming and proceeds level underwater. If the control for forward thrust is released, the sub will surface because of its positive buoyancy. If both forward and reverse thrust is applied the sub will continue in a forward but slightly up direction since the forward bilge pumps are more powerful than the reverse pump and a the reverse pump tends to raise the forward end up providing a slight towards the surface.

[0009] Thus there are actually two ways to surface the sub. Either the controls can be completely released and the sub will surface directly, or with both forward and reverse controls on the sub will gradually surface at an incline.

[0010] The forward bilge pump excurrent thrusters or pipes located at the rear of the submarine are positioned below the centerline, a brass nozzle (s) can be fitted to constrict the opening, increasing thrust. The down bilge pump with its ex current thruster located at the very front of the submarine in combination with the forward thrust and forward tilt down will submerge the submarine. This of course requires proper balance (trimming) and proper positive buoyancy.

[0011] Approximately 10% (can vary) of the submarine resides above the surface. The proper ballast of the submarine is as important as proper bilge pump power, or speed. Battery capacity, affecting ballast, is also important. Without sufficient forward thrust (battery power/bilge pump power) the sub will not have enough power to submerge. Large batteries while supplying sufficient power may be excessively heavy sinking the submarine. The proper balance of all these factors is required for this submarine to work properly as described herin.

[0012] There are a number of variables that require exact adjustment with this submarine. The speed has to be sufficient to push the submarine underwater, to get the proper speed the correct size bilge pumps are needed with a sufficient amount of battery power. Too much battery power will weigh too much and too much bilge pump power will cut short the running time. There are no moving parts in this submarine yet it submerges under control, will rise to the surface, cannot be sunk and turns underwater. If you lose sight of the submarine while underwater required only to raise the sub is the release of the controls and it will surface.

[0013] All of the exact specifications of this submarine can be derived from the working prototype. Much of the working knowledge of this submarine has been obtained from empirical manipulation and experimentation and is contained in the working prototype.

What is Claimed is:

[c1] A method of propelling a model submarine using bilge pumps and exacting buoyancy to allow a completely functional model without any external moving parts; this is accomplished with fixed directional water jet nozzles providing thrust powered by bilge pumps acting as miniature turbine units, directional nozzles in the front of the sub are used for turning, reverse, and submerging, water jet nozzles in the rear of the sub provide forward thrust, surfacing is accomplished by terminating forward thrust either by design or through loss of signal.

[c2] A method according to claim 1which can be applied to model submarine's varying in length from 4ft to 7 ft. (or some other reasonable length) based on 4 ft. and 7 ft. prototypes.

[c3] The proposed control/propulsion system is significantly different from referenced embodiments, the system proposed herein is the only system which uses individual bilge pumps for directional control including submerging, the proposed control/propulsion system is very simple by comparison, Figures 1 through 5 show the complete system, components of which are a sealed battery, to supply power, a watertight chamber made of PVC pipe or any other suitable material in which a radio receiver, solid-state electrical switches and automotive type relays are located, the watertight chamber merely serves to keep the electrical components dry and the electrical components merely distribute power (through wires exiting the watertight chamber) to the various bilge pumps to provide thrust and control direction, the other components are the bilge pumps themselves, plumbing consisting of PVC pipe and brass nozzles and the various wires to supply power to the bilge pumps, the main components are thus simply, the battery, the watertight chamber, and the bilge pumps making an extremely simple control/propulsion system.

[c4] The proposed control/propulsion system is significantly different from Cicoff etc. (6,601,333), which is for a game decoy, which does not submerge and while a propulsion system is proposed, it uses functionally equivalent RC servos or solenoids to operate a three-way directional valve, this is similar to other referenced embodiments where instead of hydraulic servos being used to activate dive planes and rudder's, Cicoff etc proposes mechanical/electrical operation of a directional valve, whereas in the system proposed herein there are no moving directional valves, connecting rods, solenoid switches or servos or equivalent electro/mechanical devices, jet nozzles are fixed and powered by individual bilge pumps, furthermore this game decoy is not proposed as a submarine having the ability to submerge as in the proposed embodiment.

[c5] A method according to claim 1 which can be applied to model submarines varying in length from 4ft to 7 ft. (or some other reasonable length/size/shape) based on 4 ft. and 7 ft. prototypes, where the size and number of individual bilge pumps may vary to meet different requirements imposed by different restraints according to hull size and internal dimensions, as an example a large submarine may require two bilge pumps for a down direction whereas a smaller hull may suffice with only one; size and/or length of a model submarine would be reasonably limited by the size of available bilge pumps, a submarine that is too small or of

limited internal space would be limited by the size of the smallest bilge pump currently available which provides functionality as described in accordance with claim 1, likewise, too large a submarine would be limited by the largest bilge pump available and able to provide functionality as described consonant with claim 1.

Abstract of the Disclosure

[0011] A control/propulsion system for a model submarine 4 to 7 ft. in length, (can vary within reasonable limits) using bilge pumps, RC components, and exacting ballast to make the submarine completely functional without any external moving parts such as propeller, rudder, and dive planes. Unlike most model submarines which use external moving parts for directional control such as propeller, dive planes and rudder, the proposed control/ propulsion system accomplishes complete directional control without the use of any external moving parts. This is accomplished with bilge pumps providing jet water thrust through fixed nozzles for all directions, forward, reverse, left, right and down. Since the submarine is positively buoyant the cessation of forward thrust allows the submarine to surface. This is an added safety feature in case of loss of radio signal. Additionally the functional components of the proposed control/ propulsion system are extremely simple compared to other typical model submarines. The major components are simply a battery, to supply power, a watertight chamber, housing the radio and electrical components, bilge pumps, to provide jet water thrust, and fixed directional nozzles and plumbing to provide desired directional control. The simplicity of this system greatly enhances the reliability of the model submarine and provides trouble-free operation for many hours without the concern of losing the submarine.

Description Of The Drawings

Figures 1 through 4 show a view from the top of a fusiform model submarine hull with the various embodiments. Main components shown are bilge pumps and their associated plumbing and fixed nozzles, the battery, and the watertight chamber.

Figure 5 is a depiction of the watertight chamber and the various embodiments contained therein. These components consist of a typical RC radio receiver,

solid-state switches plugged into the receiver converting the typical digital pulse into an on-off switch which in turn operates automotive type relays. Power from the battery comes into the watertight chamber and is distributed by the relays and other components to the various bilge pumps for directional control.

Description Of The Preferred Embodiments

Figure 1 - A top View of the model fusiform submarine hull varying in length from 4 ft. to 7 ft. or some other reasonable dimension showing bilge pumps 2 and 4 which are the left and right (port and starboard) directional pumps. 7/8" PVC pipe 6, 8 (can vary in size and material depending on size of the bilge pump) carries water from the bilge pump to the 90 degree brass nozzles 10, 12 exiting the hull at the bow of the ship. Bilge pumps 14, 16 are the forward directional pumps providing jet water through PVC pipes 18, 20. Water exits through straight brass nozzles 22, 24 providing forward thrust.

Figure 2 - A top View of the model fusiform submarine hull varying in length from 4 ft. to 7 ft. or some other reasonable dimension, showing the watertight chamber 26 and the sealed battery 28.

Figure 3 - A top View of the model fusiform submarine hull varying in length from 4 ft. to 7 ft. or some other reasonable dimension showing the down bilge pumps 30, 32 and 7/8" PVC pipe 34, 36 (can vary in size and material depending on size of the bilge pump) carries water from the bilge pump to the 90 degree brass nozzles 38,40 exiting upward.

Figure 4 - A top View of the model fusiform submarine hull varying in length from 4 ft. to 7 ft. or some other reasonable dimension showing the reverse bilge pump 42 and 7/8" PVC pipe exiting water to the front jet brass straight nozzle 46. Can also exit from a nozzle at the bottom.

Figure 5 - A depiction of the watertight chamber, can vary in size and material e.g. PVC pipe, such that it is sufficiently large to contain the required electrical

components. The radio receiver 48, the solid-state electrical switch 50 converting pulse signal (proportional) to on-off to operate the automotive type relays 52 with wires exiting the sealed plug 54 to distribute power to the various bilge pumps for directional control.

Description Of The Pictures

Picture 1 -- picture of 4 ft. sub
Picture 2 -- picture of 7 ft. sub
Picture 3 -- picture of typical bilge pump
Picture 4 -- picture showing placement of bilge pumps in model submarine hull.
Picture 5 -- picture showing solid-state switching device
Picture 6 -- picture showing typical automotive type relays

References Cited [Referenced By]

U.S. Patent Documents

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